

APPENDIX A

Methodology for Urban and Agricultural Demand Projections

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Demand Assessments and Projections

Demand assessments for 2000 and projections for 2025 were made for the following water use categories:

- 1) Public Water Supply (PWS)
- 2) Domestic Self-Supply and Small Public Supply Systems
- 3) Commercial/Industrial Self-Supply
- 4) Recreational Self-Supply
- 5) Thermoelectric Power Generation Self-Supply
- 6) Agricultural Self-Supply

Water demand projections through the year 2025 included analyses under average rainfall conditions and under drought conditions. These projections are based on current trends and circumstances. Projections should therefore be understood as surprise free, and imply an extension of current production, market, and legal circumstances.

In addition, the projections are unconstrained by supply availability or demand management (conservation). Therefore, there is the opportunity to reduce these projected demand levels through the policies and activities that would be put in place based on potential or observed negative natural resource impacts, or in response to actual drought events.

Wherever population represented an independent variable for projection purposes (the first four categories of use), the county assessment by the U.S. Bureau of the Census (2000) was used for 2000 and the medium range county population projections published by the Bureau of Economic and Business Research (BEBR, 2002) was used for the 2025 time horizon.

Wherever irrigation requirements are calculated (for agricultural and recreational use), the Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) model was used. Irrigation requirements were calculated for average and 1-in-10 year droughts. Irrigation requirements are equal to the difference between evapotranspiration and effective rainfall. Effective rainfall is equal to the rainfall that is stored in the plant root zone. Changing rainfall levels and timing therefore affect irrigation requirements. However, agricultural and urban irrigation managers may not collectively respond proportionally to dissimilar rainfall patterns. Observed demand levels will vary based on irrigation managers' perceptions and responses to changing rainfall patterns.

Realistically, some may allow plants to experience some level of stress before changing irrigation schedules, while others may habitually over-water at a level that satisfies irrigation demands even during drought events.

For agricultural and recreational irrigation demands, the 2000 assessed and 2025 projected irrigated acreages were applied to the average and 1-in-10 demand rates at the appropriate rainfall station and general soil type.

For PWS and Domestic Self-Supplied demands, the 2000 demand per capita rates were considered to represent the drought level demand rates (per capita), and these demand rates were applied to the relevant projected populations. Projected average demands were reached by subtracting six percent (based on consultations with FDEP).

Average and 1-in-10 Rainfall

An average rainfall year is defined as a year with rainfall equal to the mean annual rainfall for the period of record. A 1-in-10 year drought condition is defined as below normal rainfall with a 90 percent probability of being exceeded over a 12-month period. This means that there is a 10 percent chance that less than this amount will be received in any given year. Section 373.0361(2)(a)1, F.S. states that the level of certainty planning goal associated with identifying demands shall be based upon meeting demands during a 1-in-10 year drought event.

CATEGORIES OF WATER USE

(1 & 2) Public Water Supply and Domestic Self-Supplied Demands

PWS and Domestic Self-Supply demand assessments and projections were developed for 2000 and 2025. The Domestic Self-supplied category includes small public supply systems with projected demands of less than 0.1 million gallons per day (MGD) in 2025 as well as residents that supply their own water needs. Self-supplied residents may be within utility boundaries or outside of utility boundaries. Water demands were forecast by multiplying population projections by per capita water use rates. Per capita water use rates were calculated based on 2000 population data from the U.S. Bureau of the Census (2000) and the water pumpage for each utility as reported by the U.S. Geological Survey (USGS, 2000). The population projections for 2025 for each county were based on the medium range forecasts published by the University of Florida Bureau of Economic and Business Research (BEBR, 2002).

The 2000 and projected 2025 utility served areas used in this analysis were obtained from the utilities. Adjustments were made to account for the known future expansion of the current served areas. It was assumed that all projected population growth within areas being served by a utility would be connected to that PWS system.

The proportions of populations within utility served areas into PWS supplied and Domestic Self-Supplied categories were modified in several instances based on utility input.

Per Capita Rates

Per capita water use rates for 2000 for each utility were calculated by dividing raw water pumped by the permanent resident population served by PWS utilities. The USGS and District pumpage reports provided raw water withdrawal data. Total population and the number of individuals served by the utilities were determined by the above-mentioned methodology.

These per capita rates include total use, incorporating use by seasonal residents and tourists, commercial and industrial utility supplied use, and the losses incurred in water delivery, in addition to the use by permanent residents. Irrigation demand for PWS served households using private well water for their landscape irrigation was not assessed due to the lack of available data.

The year 2000 was a drought year (which actually exceeded a 1-in-10 year level of recurrence); therefore, per capita rates for 2000 were used to develop the drought 2025 utility demand projections. Adjustments were then made to these projections to normalize them for average rainfall conditions.

Domestic Self-Supply per capita rates within PWS utility served area boundaries were assumed to be the same as for the utility served that service area. The per capita rates for the Domestic Self-supplied users in areas not served by public utilities were assumed to be the weighted average of the PWS per capita rates for the county.

PWS and Domestic Self-Supplied Average and 1-in-10 Year Drought Adjustments

Indoor use categories need no adjustment from the 2000 (drought) observed values to an average year, as these categories would have no demand shifts related to drought. Unadjusted base demand for a utility was projected by multiplying a base year per capita rate by a projected population. If desired, the withdrawal distribution (by month) can be derived from historical demand curves for the utility. The difference between the monthly demand for the base year and the unconstrained demand for an average year or a 1-in-10 year will directly depend on the changes in the outdoor use, specifically, changes in demand for landscape irrigation. If the base year is an average year, then there is no need for an adjustment from base to average. However, if the base year is significantly wetter or drier than average, then unconstrained demands for outdoor use will adjust proportionally.

Population Served

2000 Population

U.S. Census data were used as the basis for the 2000 population and the distribution of that population. Block level information from the census count was used as the basic unit of analysis. Total population, occupied housing units, and persons per occupied housing unit were retrieved from census data. In the absence of a self-supplied unit count in the 2000 Census, the self-supplied population within utility served areas was taken as a constant based on the 1990 Census (which included household water source on its long form).

The geographic areas represented by the census blocks and the utility served areas were input as polygon layers into the SFWMD Geographic Information System (GIS). The two layers were overlaid to make a decision if census blocks were inside or outside the area served by each utility. Imagery was used to review decisions when necessary. Population assessments of PWS served and Domestic Self-supplied were then calculated. The populations for each utility served area were then totaled.

2025 Population Projections

The medium range county projections as published by BEBR (2002) were used as county population projection control totals for 2025. The geographic distribution of the 2025 population was assessed using the ratio of Traffic Analysis Zone (TAZ) population growth for the areas covered by TAZs. The geographic distribution of the 2025 population for areas not covered by TAZs was based on the population distribution in the 2000 census block data. Total county population was limited to the county total from the BEBR medium range projections.

The two layers were overlaid to make a decision if TAZs were inside or outside the area served by each utility. Population estimates were then recalculated for the new attribute by deciding which polygons were inside or outside of utility served boundaries. The populations for each utility served area were then totaled and limited not to exceed the BEBR medium range population projection for each county.

Any growth in population within an area being served by a utility was assigned to that utility. This means that within utility served areas, the Domestic Self-supplied population was assumed to remain the same from 2000 to 2025. Any growth in population within an area not planned to be served by a utility was assigned to the Domestic Self-supplied category. **Table A-1** outlines the columns showing projection calculations for PWS and Domestic Self-supplied users, and **Tables A-2** through **A-7** show these projections for the counties partially in the Kissimmee Basin Water Supply Planning Area (Orange, Osceola, Polk, Highlands, Glades and Okeechobee).

Table A-1. Column Legend for the Public Water Supplied and Domestic Self-Supplied Demand Projections Table for each County.

Columns	Heading	Description
(a)	Utility	Name of the public water supply utility for which 2000 assessments and 2025 projections are made.
(b)	Total Population 2000/2025	Permanent resident population that resides within each utility's area served boundaries.
(c)	PWS Population 2000/2025	Permanent resident population served by each PWS utility.
(d)	PWS Base (drought) MGD 2000/(2025)	For 2000, pumpage reported by the USGS. For 2025, projected demands based on the projected population served multiplied by the gallons per capita day (GPCD) observed in 2000 (column e).
(e)	GPCD 2000/2025: Gallons Per Capita Day	For 2000, pumpage reported by the USGS (column d) divided by permanent resident population served by each PWS utility (column c). For 2025, this per capita rate is the same as observed in 2000 for each utility.
(f)	DSS Population	Permanent resident population not served by each PWS utility that resides within each utility's active service boundaries.
(g)	DSS Base MGD 2000/2025	Assessed demands based on the self-supplied population (column f) multiplied by the gallons per capita day (GPCD) observed in 2000 (column e).
(h)	Average Factor	Proportional difference between county per capita usage for the county in 2000 and the most recent average rainfall year – as reported by the USGS, up to a maximum of a 6 percent difference (DEP standard).
(i)	PWS Average MGD 2025	For 2025 PWS drought MGD (column d) for each utility for 2025 multiplied by the average factor (column h).
(j)	DSS Average MGD 2000/2025	For 2025 DSS drought MGD (column g) for each utility for 2025 multiplied by the average factor (column h).

Table A-2. Public Water Supplied and Domestic Self-Supplied Demand Projections for the Southern Orange County.

a	b	c	d	e	f	g	h	i	j
Utility	Total Popn 2000	PWS Popn 2000	PWS Base MGD 2000	GPCD 2000	DSS Popn 2000	DSS Base MGD 2000			
Kissimmee, City of	1,362	1,362	0.36	262	0	0.00			
Orange County Public Utilities	58,707	47,993	15.12	315	10,714	3.38			
Orlando Utilities Commission	154,257	146,471	40.65	277	7,786	2.16			
Reedy Creek	72	72	19.94	N/A	0	0.00			
Taft Water Association	2,110	2,110	0.27	128	0	0.00			
Rural Self-Supplied	3,557			386	3,557	1.37			
Totals	220,065	198,008	76.34		22,057	6.91			
Orange County Outside KB Area	676,279								
Orange County Total	896,344								
Census 2000	896,334								
Utility	Total Popn 2025	PWS Popn 2025	PWS Drought MGD 2025	GPCD 2025	DSS Popn 2025	DSS Drought MGD 2025	Avg Factor	PWS Avg MGD 2025	DSS Avg MGD 2025
Kissimmee, City of	2,833	2,833	0.74	262	0	0.00	0.94	0.70	0.00
Orange County Public Utilities	200,680	189,966	59.87	315	10,714	3.38	0.94	56.28	3.17
Orlando Utilities Commission	263,086	255,300	70.84	277	7,786	2.16	0.94	66.59	2.03
Reedy Creek	72	72	23.40	N/A	0	0.00	0.94	22.00	0.00
Taft Water Association	2,710	2,710	0.35	128	0	0.00	0.94	0.33	0.00
Rural Self-Supplied	27,197			386	27,197	10.49	0.94		9.86
Totals	496,578	450,881	155.20		45,697	16.02		145.89	15.06
Orange County Outside KB Area	994,524								
Orange County Total	1,491,102								
BEBR Medium	1,491,100								

Table A-3. Public Water Supplied and Domestic Self-Supplied Demand Projections for the Western Osceola County.

a	b	c	d	e	f	g	h	i	j
Utility	Total Popn 2000	PWS Popn 2000	PWS Base MGD 2000	GPCD 2000	DSS Popn 2000	DSS Base MGD 2000			
Buenaventura Lakes	21,819	21,453	2.09	97	366	0.04			
Pine Ridge Estates	488	488	0.14	282	0	0.00			
Tropical Park	883	883	0.11	100	0	0.00			
Kissimmee, City of	80,750	79,063	21.51	272	1,687	0.46			
Poinciana Utilities	14,844	14,366	1.76	123	478	0.06			
St. Cloud	31,860	31,373	3.28	105	487	0.05			
Tropical Palms Resort	1,536	1,536	0.12	78	0				
Rural Self-Supplied	19,236			194	19,236	3.74			
Totals	171,416	149,162	29.01		22,254	4.35			
Osceola County Outside KB Area	1,077								
Osceola County Total	172,493								
Census 2000	172,493								
Utility	Total Popn 2025	PWS Popn 2025	PWS Drought MGD 2025	GPCD 2025	DSS Popn 2025	DSS Drought MGD 2025	Avg Factor	PWS Avg MGD 2025	DSS Avg MGD 2025
Buenaventura Lakes	32,667	32,301	3.15	97	366	0.04	0.94	2.96	0.03
Pine Ridge Estates	488	488	0.14	282	0	0.00	0.94		
Tropical Park	1,162	1,162	0.12	100	0	0.00	0.94	0.11	0.00
Kissimmee, City of	131,724	130,037	35.38	272	1,687	0.46	0.94	33.26	0.43
Poinciana Utilities	66,012	65,534	8.03	123	478	0.06	0.94	7.55	0.06
St. Cloud	60,562	60,075	6.28	105	487	0.05	0.94	5.90	0.05
Tropical Palms Resort	1,536	1,536	0.12	78	0	0.00	0.94	0.11	0.00
Rural Self-Supplied	25,337			194	25,337	4.93	0.94		4.63
Totals	319,488	291,133	53.22		28,355	5.53		49.89	5.20
Osceola County Outside KB Area	7,011								
Osceola County Total	326,499								
BEBR Medium	326,500								

Table A-4. Public Water Supplied and Domestic Self-Supplied Demand Projections for the Eastern Polk County.

a	b	c	d	e	f	g	h	i	j
Utility	Total Popn 2000	PWS Popn 2000	PWS Base MGD 2000	GPCD 2000	DSS Popn 2000	DSS Base MGD 2000			
Poinciana Utilities	4,629	4,629	1.57	339	0	0.00			
Oak Hill Estates *census analysis pending	450	450	0.45	1000	0				
Rural Self-Supplied	7,316			339	7,316	2.48			
Total	12,395	5,079	1.57		7,316	2.48			
Polk County Outside KB Area	471,525								
Polk County Total	483,920								
Census 2000	483,924								
Utility	Total Popn 2025	PWS Popn 2025	PWS Drought MGD 2025	GPCD 2025	DSS Popn 2025	DSS Drought MGD 2025	Avg Factor	PWS Avg MGD 2025	DSS Avg MGD 2025
Poinciana Utilities	6,480	6,480	2.20	339	0	0.00	0.94	2.07	0.00
Oak Hill Estates *TAZ analysis pending	4,500	4,500	4.50	1000	0	0.00	0.94	4.23	0.00
Rural Self-Supplied	11,519			339	11,519	3.91	0.94		3.67
Total	22,499	10,980	6.70		11,519	3.91		6.29	3.67
Polk County Outside KB Area	659,101								
Polk County Total	681,600								
BEBR Medium	681,600								

Table A-5. Public Water Supplied and Domestic Self-Supplied Demand Projections for the Eastern Highlands County.

a	b	c	d	e	f	g	h	i	j
Utility	Total Popn 2000	PWS Popn 2000	PWS Base MGD 2000	GPCD 2000	DSS Popn 2000	DSS Base MGD 2000			
Spring Lake Improvement District	1,722	1,722	0.23	134	0	0			
Rural Self-Supplied	7,779			134	7,779	1.04			
Total	9,501	1,722	0.23		7,779	1.04			
Highlands County Outside KB Area	77,865								
Highlands County Total	87,366								
Census 2000	87,366								
Utility	Total Popn 2025	PWS Popn 2025	PWS Drought MGD 2025	GPCD 2025	DSS Popn 2025	DSS Drought MGD 2025	Avg Factor	PWS Avg MGD 2025	DSS Avg MGD 2025
Spring Lake Improvement District	2,492	2,492	0.33	134	0	0.00	0.94	0.31	0.00
Rural Self-Supplied	11,263			134	11,263	1.50	0.94		1.41
Total	13,755	2,492	0.33		11,263	1.50		0.31	1.41
Highlands County Outside KB Area	112,808								
Highlands County Total	126,563								
BEBR Medium	126,600								

Table A-6. Public Water Supplied and Domestic Self-Supplied Demand Projections for the Northern Glades County.

a	b	c	d	e	f	g	h	i	j
Utility	Total Popn 2000	PWS Popn 2000	PWS Base MGD 2000	GPCD 2000	DSS Popn 2000	DSS Base MGD 2000			
Lakeport Water Association	1,144	1,144	0.13	114	0	0.00			
Okeechobee Utility	1,415	1,415	0.15	105	0				
Rural Self-Supplied	1,136			109	1,957	0.21			
Total	3,695	2,559	0.28		1,957	0.21			
Glades County Outside KB Area	6,881								
Glades County Total	10,576								
Census 2000	10,576								
Utility	Total Popn 2025	PWS Popn 2025	PWS Drought MGD 2025	GPCD 2025	DSS Popn 2025	DSS Drought MGD 2025	Avg Factor	PWS Avg MGD 2025	DSS Avg MGD 2025
Lakeport Water Association	1,632	1,632	0.19	114	0	0.00	0.94	0.17	0.00
Okeechobee Utility	2,022	2,022	0.21	105	0	0.00	0.94	0.20	0.00
Rural Self-Supplied	1,632			109	1,632	0.18	0.94	0.37	0.17
Total	5,286	3,654	0.40		1,632	0.18		0.75	0.17
Glades County Outside KB Area	9,815								
Glades County Total	15,101								
BEBR 2025	15,100								

Table A-7. Public Water Supplied and Domestic Self-Supplied Demand Projections for the Western Okeechobee County.

a	b	c	d	e	f	g	h	i	j
Utility	Total Popn 2000	PWS Popn 2000	PWS Base MGD 2000	GPCD 2000	DSS Popn 2000	DSS Base MGD 2000			
Okeechobee Utility Authority	19,742	12,205	2.21	181	7,537	1.36			
Rural Self-Supplied	13,579			181	13,579	2.46			
Totals	33,321	12,205	2.21		21,116	3.82			
Okeechobee County UEC	1,914								
Okeechobee County St. Johns	675								
Okeechobee County Total	35,910								
Census 2000	35,910								
Utility	Total Popn 2025	PWS Popn 2025	PWS Drought MGD 2025	GPCD 2025	DSS Popn 2025	DSS Drought MGD 2025	Avg Factor	PWS Avg MGD 2025	DSS Avg MGD 2025
Okeechobee Utility Authority	28,660	21,123	3.82	181	7,537	1.36	0.94	3.60	1.28
Rural Self-Supplied	14,698			181	14,698	2.66	0.94		2.50
Totals	43,358	21,123	3.82		22,235	4.03		3.60	3.78
Okeechobee County UEC	2,502								
Okeechobee County St. Johns	884								
Okeechobee County Total	46,744								
BEBR 2025	46,700								

(3) Commercial/Industrial Self-Supply

The employment by sector was evaluated regarding the predominant types of employment found in the District, and whether these employment types could be anticipated to grow at the same rate and in the same direction as the population. In the SFWMD, the majority of the employees are found in the service and retail sales sectors, indicating that water demand by these sectors will generally grow along with the population. Demand for this category of water use was projected to grow at the rate of each county's population growth. Water used for commercial and industrial purposes supplied by utilities is included with other utility demands. **Table A-8** summarizes KB Commercial and Industrial demand projections; 2000 use was assessed from SFWMD permits.

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County Area	2000	2005	2010	2015	2020	2025
Southern Orange	6.33	7.92	9.51	11.10	12.69	14.28
Western Osceola	0.32	0.38	0.44	0.49	0.55	0.61
Eastern Polk	0.05	0.06	0.07	0.08	0.08	0.09
Eastern Highlands	3.15	3.43	3.71	3.99	4.28	4.56
Western Okeechobee	3.98	4.21	4.45	4.69	4.93	5.17
Total MGD	13.83	16.00	18.18	20.35	22.53	24.71

(4) Recreation Self-Supply

The recreational self-supplied demand category includes self-supplied irrigation demands for large landscaped and recreational areas (as opposed to private homes), and for golf courses. Because of the data sources available, golf course demands by county are projected separately and added to the other landscape and recreation demands. Non-golf course landscaping and recreational water use was assumed to increase at the same rate as the county population, with 2000 used as the base year. Recreational irrigation requirement estimates for average and 1-in-10 year droughts were made using the AFSIRS model. The irrigation requirements were calculated similarly to other irrigation requirements, using a representative irrigation system/rainfall station/soil type combination for each county.

Landscape

Demand projections for this sub-category include irrigated acreage permitted for landscaping and recreation, excluding golf courses. Landscaping acreage was projected to increase at the same rate as the county population, with 2000 used as the base year. Acreage projections for large scale landscaping and recreation self-supplied acreages are outlined in **Table A-9**.

Table A-9. Landscape Self-Supplied Acreage.

County	2000	2005	2010	2015	2020	2025
Southern Orange	2,264	2,833	3,402	3,971	4,540	5,109
Western Osceola	24	28	32	36	41	45
Eastern Polk	16	23	30	37	44	51
Eastern Highlands	7	8	8	9	10	10
Northern Glades	10	11	12	13	13	14
Western Okeechobee	30	32	34	35	37	39
Total Acres	2,351	2,934	3,518	4,101	4,684	5,268

Golf Courses

For golf course projections, historical irrigated golf course acreage data were gathered from the District's Consumptive Use Permitting (CUP) database, the Golf Course Directory (National Golf Foundation, 2001), and personal communication with staff from several of the golf courses listed. Irrigated golf course acreage projections were made by statistically correlating historical acreage to historical population, or to a time trend, or to both. Projections were made for total irrigated golf course acreage, and those currently supplied by a reuse or potable utility systems subtracted from the projection.

Southern Orange County

Golf courses currently in Orange County are shown in **Table A-10**. As in other counties, the growth in golf course acreage has occurred irregularly on a year-by-year basis. **Equation A-1** (using an ARIMA model) was estimated to project irrigated golf course acreage in Southern Orange County (the portion of Orange County within the KB Planning Area). Golf course outside the KB have zero (0) "SFWMD irrigated acres" in **Table A-10**.

Table A-10. Golf Courses in Orange County.

Name	Year Opened	SFWMD Irrigated Acres	SFWMD Self-Supplied Acres
Winter Park	1916	0	0
CC of Orlando	1921	0	0
Dubsdread	1922	0	0
Rio Pinar	1958	0	0
Eaglewood GC	1958	332	332
Naval Training Center	1962	0	0
Bay Hill ¹	1964	180	0
Wedgefield	1965	0	0
Winter Pines	1965	0	0
West Orange	1967	0	0
Greens Golf ¹	1968	35	0

Name	Year Opened	SFWMD Irrigated Acres	SFWMD Self-Supplied Acres
Cypress Creek ¹	1970	120	0
LBV Oak Trail Golf Club ¹	1971	58	0
Disney-Magnolia ¹	1971	160	0
Errol	1971	0	0
Deer Run	1972	0	0
Fairways	1972	0	0
Lake Buena Vista ¹	1972	145	0
Rosemont	1972	0	0
Orange Tree ¹	1973	94	0
Sweetwater	1974	0	0
Zellwood Station	1974	0	0
Ventura	1980	0	0
McCoy Annex	1981	30	30
Boggy Creek	1982	27	27
Orange Lake	1982	238	238
Grand Cypress ¹	1983	477	0
Interlachen	1985	0	0
Meadow Woods ¹	1985	105	0
Hunters Creek ¹	1986	180	0
Isleworth ¹	1986	179	0
Lake Nona ¹	1986	161	0
Marriott's Orlando ¹	1986	95	0
Windemere ¹	1986	140	0
International ¹	1987	110	0
Metro West ¹	1987	109	0
Orangewood ¹	1987	138	0
Golf World	1988	0	0
Eastwood Golf Course	1989	120	120
Naval Training Center	1990	0	0
Bonnet Lakes	1991	145	145
Glenmuir	1993	512	512
Forest Lake	1994	0	0
Eagle Pines ¹	1995	70	0
Osprey Ridge	1995	120	120
Palm	1995	120	120
Exec. Nine	1995	30	30
Faldo Golf Institute	1996	80	80
Stoneybrook East	1997	0	0
Orange County NGC	1997	0	0
Rock Springs Ridge	1998	0	0
Keene's Point ¹	1999	263	0
Lake Hart GC ¹	2000	96	0
Lake Orlando	2000	0	0
Stoneybrook West	2001	120	120
Total		4,789	1,874

1. Irrigated with reuse.

Equation A-1.

Model Parameters:	Estimate	T
Moving Average (lagged 1)	0.8247	5.1214
Autoregressive (lagged 1)	0.9638	12.7958

Goodness-of-fit Statistics:

	Value
Root Mean Square Error	160.28014
Mean Absolute Percent Error	5.78781
Mean Absolute Error	100.58411
R-Square	0.989

When **Equation A-1** was estimated, the results shown in **Table A-11** were obtained. Future expansion of golf courses were all considered to be potentially self-supplied.

Table A-11. Irrigation Requirements For Projected Self-Supplied Golf Courses In Southern Orange County.

		2000	2005	2010	2015	2020	2025
Irrigated Acreage		4,549	4,810	5,158	5,447	5,688	5,888
Self-Supplied Irrigated Acreage		1,754	2,015	2,363	2,652	2,893	3,093
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.7	44	51	60	67	73	78
February	1.1	70	80	94	106	115	123
March	2.0	127	146	171	192	209	224
April	3.2	203	233	274	307	335	358
May	3.3	210	241	282	317	346	370
June	1.8	114	131	154	173	189	202
July	1.4	89	102	120	134	147	157
August	1.0	64	73	86	96	105	112
September	0.8	51	58	68	77	84	90
October	1.1	70	80	94	106	115	123
November	0.9	57	66	77	86	94	101
December	0.6	38	44	51	58	63	67
Total	17.9	1,137	1,306	1,532	1,719	1,875	2,005
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.9	57	66	77	86	94	101
February	1.4	89	102	120	134	147	157
March	2.4	152	175	205	230	251	269
April	3.7	235	270	317	355	388	414
May	3.8	241	277	325	365	398	426
June	2.4	152	175	205	230	251	269
July	1.9	121	139	163	182	199	213
August	1.4	89	102	120	134	147	157
September	1.2	76	88	103	115	126	134
October	1.2	76	88	103	115	126	134
November	1.1	70	80	94	106	115	123
December	0.8	51	58	68	77	84	90
Total	22.2	1,410	1,620	1,899	2,132	2,325	2,486

Western Osceola County

Golf courses currently in Osceola County are shown in **Table A-12**. All golf courses currently within Osceola County are within the SFWMD. As in other counties, the growth in golf course acreage has occurred irregularly on a year-by-year basis. **Equation A-2** (using a damped trend exponential smoothing model) was estimated to project irrigated golf course acreage in Western Osceola County.

Table A-12. Golf Courses in Osceola County.

Name	Year Opened	Irrigated Acres	Self-Supplied Acres
Kissimmee GC (Airport Inn) ¹	1965	100	0
Kissimmee GC ¹	1970	37	0
Buenaventura Lakes CC ¹	1975	65	0
Crystalbrook Golf Club	1979	18	18
Osceola Golf Club	1984	120	120
Kissimmee Oaks GC ¹	1985	158	0
Kissimmee Bay CC ¹	1990	85	0
Million Dollar Mulligan	1990	60	60
Falcon's Fire Golf Club (Saralago) ¹	1993	170	0
Celebration Golf Club ¹	1996	120	0
Remington Golf Club ¹	1996	102	0
The Palms (Tempus Palms, Mystic Dunes) ¹	1998	140	0
The Palms (Tempus Palms, Mystic Dunes) ¹	1999	24	0
Champions Gate Golf Resort ¹	2000	225	0
Total		1,424	198

1. Irrigated with reuse.

Equation A-2.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	0.5868	0.1292	4.5411	<.0001
TREND Smoothing Weight	0.2732	0.2051	1.332	0.192
DAMPING Smoothing Weight	0.999	0.0648	15.4183	<.0001
Residual Variance (sigma squared)	4238			
Smoothed Level	1366			
Smoothed Trend	97.18155			
Goodness-of-fit Statistics:	Value			
Mean Square Error	3884.6			
Root Mean Square Error	63.32642			
Mean Absolute Percent Error	9.10521			
R-Square	0.971			

When **Equation A-2** was estimated, the results shown in **Table A-13** were obtained. Future expansion of golf courses were all considered to be potentially self-supplied.

Table A-13. Irrigation Requirements for Projected Self-Supplied Golf Courses in Western Osceola County.

		2000	2005	2010	2015	2020	2025
Irrigated Acreage		1,424	1,851	2,333	2,812	3,290	3,765
Self-Supplied Irrigated Acreage		198	625	1,107	1,586	2,064	2,539
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.1	8	25	44	63	82	101
February	1.4	10	32	56	80	105	129
March	2.4	17	54	96	138	179	221
April	3.6	26	81	144	207	269	331
May	3.5	25	79	140	201	262	322
June	1.6	11	36	64	92	120	147
July	1.3	9	29	52	75	97	120
August	1.1	8	25	44	63	82	101
September	1.1	8	25	44	63	82	101
October	1.4	10	32	56	80	105	129
November	1.2	9	27	48	69	90	110
December	0.8	6	18	32	46	60	74
Total	20.5	147	464	822	1,177	1,532	1,885
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.4	10	32	56	80	105	129
February	0.3	2	7	12	17	22	28
March	2.7	19	61	108	155	202	248
April	3.7	27	84	148	212	277	340
May	3.8	27	86	152	218	284	349
June	2.2	16	50	88	126	164	202
July	1.9	14	43	76	109	142	175
August	1.2	9	27	48	69	90	110
September	1.4	10	32	56	80	105	129
October	1.8	13	41	72	103	135	165
November	1.4	10	32	56	80	105	129
December	1.6	11	36	64	92	120	147
Total	23.4	168	530	938	1,344	1,749	2,151

Other Kissimmee Basin Counties

With the exception of Orange and Osceola Counties, there are relatively few golf courses in the Kissimmee Basin. These are shown in **Tables A-14** through **A-16**, and there are no golf courses in the KB portion of Glades County. Trend establishment is not realistic, due to the small number of courses, and there are no courses in these areas that are known to be planned, therefore the projection is for no change.

Table A-14. Golf Courses in Eastern Polk County.

Name	Year Opened	Irrigated Acres	Self-Supplied Acres
Greenlefe	1972	15	15
Poinciana	1972	120	120
Sun Air	1976	80	80
Total		215	215

Table A-15. Golf Courses in Eastern Highlands County.

Name	Year Opened	Irrigated Acres	Self-Supplied Acres
Placid Lakes CC	1966	90	90
Spring Lake G&CC ¹	1980	160	0
Total		250	90

1. Irrigated with reuse.

Table A-16. Golf Courses in Western Okeechobee County.

Name	Year Opened	Irrigated Acres	Self-Supplied Acres
Okeechobee G&CC	1966	31	31
Okeechobee KOA (Crystal Lakes)	1968	57	57
Total		88	88

Table A-17. Recreational Self-Supplied Demand Projections in the Kissimmee Basin.

COUNTY / ACREAGE / DEMAND	2000	2005	2010	2015	2020	2025
Southern Orange						
Irrigated Golf Course Acres	4,549	4,810	5,158	5,447	5,688	5,888
Self-Supplied Golf Course Acres	1,754	2,015	2,363	2,652	2,893	3,093
Self-Supplied Landscape Acres	2,264	2,833	3,402	3,971	4,540	5,109
Average Irrigation Requirement (MGY)	2,604	3,142	3,736	4,293	4,817	5,316
1-In-10 Irrigation Requirement (MGY)	3,244	3,914	4,655	5,348	6,002	6,623
Western Osceola						
Irrigated Golf Course Acres	1,424	1,851	2,333	2,812	3,290	3,765
Self-Supplied Golf Course Acres	198	625	1,107	1,586	2,064	2,539
Self-Supplied Landscape Acres	24	28	32	36	41	45
Average Irrigation Requirement (MGY)	163	480	837	1192	1547	1899
1-In-10 Irrigation Requirement (MGY)	188	553	965	1,374	1,783	2,189
Eastern Polk						
Irrigated Golf Course Acres	215	215	215	215	215	215
Self-Supplied Golf Course Acres	215	215	215	215	215	215
Self-Supplied Landscape Acres	16	23	30	37	44	51
Average Irrigation Requirement (MGY)	166	171	176	181	186	191
1-In-10 Irrigation Requirement (MGY)	194	200	206	212	218	223
Eastern Highlands						
Irrigated Golf Course Acres	160	160	160	160	160	160
Self-Supplied Golf Course Acres	90	90	90	90	90	90
Self-Supplied Landscape Acres	7	8	8	9	10	10
Average Irrigation Requirement (MGY)	72	73	73	73	74	74
1-In-10 Irrigation Requirement (MGY)	88	89	89	90	91	91
Northern Glades						
Irrigated Golf Course Acres	0	0	0	0	0	0
Self-Supplied Golf Course Acres	0	0	0	0	0	0
Self-Supplied Landscape Acres	10	11	12	13	13	14
Average Irrigation Requirement (MGY)	8	9	10	11	11	11
1-In-10 Irrigation Requirement (MGY)	10	11	12	13	13	14
Western Okeechobee						
Irrigated Golf Course Acres	88	88	88	88	88	88
Self-Supplied Golf Course Acreage	88	88	88	88	88	88
Self-Supplied Landscape Acreage	30	32	34	35	37	39
Average Irrigation Requirement (MGY)	86	88	89	90	91	93
1-In-10 Irrigation Requirement (MGY)	112	114	116	117	119	120
KB Recreational Self-Supplied Average Irrigation Requirement (MGY)	3,099	3,962	4,921	5,839	6,727	7,584
KB Recreational Self-Supplied 1-In-10 Irrigation Requirement (MGY)	3,836	4,882	6,042	7,153	8,225	9,261
KB Landscape Acres	2,351	2,935	3,518	4,101	4,685	5,268

(5) Thermo Electric Power Generation Self-Supply

Thermoelectric power plants may withdraw large quantities of water for cooling purposes. The vast majority of this water is not consumed, however, in the sense that the same water may pass through the plant repeatedly, sequentially circulating through a series of ponds. There will normally be some evaporative losses (mostly related to the cooling water being kept in ponds), that must be replaced from an external source above and beyond rainfall and runoff. This replacement was assessed for each county for which there was a permitted use. Electricity utilities were contacted (response pending) with regard to anticipated increased water needs for cooling purposes. However, within the Kissimmee Basin there were no anticipated increased needs for this purpose and demand was projected to remain at the 2000 level (0.46 MGD) through 2025.

(6) Agricultural Self-Supply

Crop acreage projections were needed for county portions that are in the KB. For counties only partially a planning region, crop acreages were frequently projected for the entire county and these projections apportioned. Unless inappropriate, this was done by assuming changes in acreage proportional to the most recently reported acreage ratios. Acreage ratios were developed with the use of District land use maps and with the cooperation of the local Institute of Food and Agricultural Sciences (IFAS) extension offices (response pending).

The techniques chosen to project crop acreages were those that were judged to best reflect the specific crop scenario in each county. This led to some variation in projection techniques between crop types and in method between counties. While it would have been ideal if a comprehensive functional form could have been found which produced tangible projections universally, no such functional form was found. The acreage projections developed here reflect a combination of methods; each deemed appropriate where used. This is consistent with the way in which crop acreage is projected by IFAS and other water management districts.

When no statistically valid trend was found, or any convincing empirical knowledge of future changes in a crop's acreage, then the specific crop's acreage was projected at its most recently reported value for future time horizons.

Average and 1-in-10 irrigation requirements were calculated using the District's AFSIRS model. Historical weather data from the rainfall station considered to best represent the crop/county combination were used to calculate irrigation requirements.

A crop's net irrigation requirement (NIR) is the amount of water used for evapotranspiration minus effective rainfall, while gross irrigation requirement (GIR) includes both the net irrigation requirement and the losses incurred in getting irrigation to the crop's root zone. Irrigation efficiency refers to the average percent of total water applied that is stored in the plant's root zone. This relationship is expressed as follows:

$$\text{Gross irrigation requirement} = \text{Net irrigation requirement} / \text{Irrigation efficiency}$$

Projections of irrigation system type, and the effect of the corresponding irrigation efficiencies, were based on the interpretation of current ratios and trends. There are three basic types of irrigation systems currently used in South Florida crop production. These are seepage (50 percent), sprinkler (75 percent), and micro-irrigation (85 percent) systems. The irrigation efficiencies estimated by the District are shown in parentheses.

Available water capacity and depth of soil have a direct effect on effective rainfall. An additional factor considered explicitly by AFSIRS, but combined with soil properties, is on-farm irrigation management strategy. The AFSIRS model, defines eight “generic” soil types representing the major kinds of soils found in Florida. All runs were made using the generic sandy soil as defined by the AFSIRS model.

Irrigated Crop Types

The irrigated commercially grown crop categories were based on the categories developed by the Water Demand Projection Subcommittee, which was made up of representatives from Florida’s five water management districts. These categories are: (1) citrus, (2) other fruits and nuts, (3) vegetables, melons, and berries, (4) field crops, (5) sod, (6) greenhouse/nursery, (7) pasture, and (8) miscellaneous. Although all of these crops are grown commercially somewhere within the District, not all are grown in the KB. Crop acreage projections were initially made by District staff based on statistical trends, and then sent out and reviewed by the local IFAS extension offices (responses pending).

Citrus

All categories of citrus (oranges, grapefruit, tangerines, limes, etc.) were grouped together for projection purposes. Historical citrus acreage data were gathered from volumes of the Commercial Citrus Inventory (Florida Agricultural Statistics Service, Various Issues) which is published biennially. Citrus is by far the main irrigated crop grown in the KB.

Other Fruits and Nuts

Within the SFWMD non-citrus fruit crops (avocados, mangos, papaya, etc.) are produced commercially, but there is no significant production of these crops in the Kissimmee Basin.

Vegetables, Melons, and Berries

A wide variety of vegetable crops are produced commercially within the KB. Information was provided from the SFWMD GIS land use maps.

Field crops

In the KB, sugarcane the only significant field crop, and has historically been cultivated in Northern Glades County, and recently also in Eastern Highlands County. Historical sugarcane acreage data were gathered from annual volumes of the Field Crops Summary (Florida Agricultural Statistics Service, Various Issues).

Sod

There is some variation in the production practices of sod within the KB. Some harvested sod is irrigated, and some is not, serving largely as pasture until the sod is sold. Since the objective here is to project irrigation requirements, only irrigated sod is addressed.

Greenhouse/Nursery

Varieties of greenhouse and nursery crops are grown within the KB. Historical commercial nursery acreage data for each county were used to make projections using functional forms that correlated nursery acreage with a time trend variable. Historical commercial nursery acreage data were gathered from annual volumes of the Division of Plant Industry's Annual Reports (Florida Department of Agricultural and Consumer Services, Various Issues).

In addition to nursery plants, there is also a region within the KB that uses land to produce caladium bulbs. Future acreages of caladium bulbs were projected based on input from the local IFAS extension office.

Pasture

Improved pasture is defined by the District as pasture that has the facilities in place to carry out irrigation. There are about two hundred thousand acres encompassed in water use permits issued by the District for pasture irrigation in the Kissimmee Basin Planning Area in 2004. Based on District knowledge and consulting with local soil and water conservation scientists, much of this acreage is rarely irrigated. This is because the returns associated with cattle production in recent years do not justify the expense associated with pasture irrigation. When irrigation is used, it is usually in a period of drought and is done to prevent grass from dying. In many cases, this occurs on a much smaller area of pasture than the "improved" total. Unless there is evidence of active pasture irrigation within a specific county, the irrigation of that acreage is not included in the primary projection scenario analyzed in the District's regional water supply plans. Although this assumption may not be the case in some rare instances, it is much closer to actual production practices than the values given by any irrigation requirement model or permit.

The water supply planning assumption that improved pasture is not irrigated does not preclude ranchers from acquiring District Consumptive Use Permits, or carrying out pasture irrigation; however, this irrigation activity is not part of the primary projection for irrigation demand in a mean or 1-in-10 year drought.

Miscellaneous

Cattle Watering

Water required for cattle watering was calculated as a function of the number and type of cattle (beef or dairy). Demand projections for cattle watering were based on the District allocation of 12 gallons/cow/day for beef cattle and 150 gal/cow/day for dairy cattle. Demand for cattle watering is projected across the KB to remain at about the 2000 level throughout the projection period. Cattle numbers for 2000 were obtained from Cattle County Estimates

Aquaculture

Aquacultural operations withdraw water for circulation purposes, and to replace evaporative losses. The replacement amount was assessed for each county for which there was a permitted use in 2000. Demand was projected to remain at the 2000 level through 2025.

Demand Projections

Citrus

Historical citrus acreage data were gathered from volumes of the “Commercial Citrus Inventory,” which is published biennially by the Florida Agricultural Statistics Service (FASS). “Commercial Citrus Inventory” data is also available from the FASS Web site: (<http://www.nass.usda.gov/fl/rtoc0ci.htm>). Statistical methods were used to project county-level citrus acreage, and the proportions of crop acreages for each county within the KB were kept constant through 2025.

Southern Orange County

Citrus acreage in Orange County was projected using log damped trend exponential smoothing. Time series data at two-year increments was used to estimate the damped trend exponential smoothing model.

Equation A-3.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	072282	0.1730	4.1770	0.0007
TREND Smoothing Weight	000100	0.1268	0.00785	0.9938
DAMPING Smoothing Weight	099542	0.0174	57.1030	<.0001
Smoothed Level	8.84542			
Smoothed Trend	-0.12586			

Goodness-of-fit Statistics:

	Value
Mean Square Error	5.2E+07
Root Mean Square Error	7232.0
Mean Absolute Percent Error	21.3791
Mean Absolute Error	4571.0
R-Square	0.909

Table A-18 shows historical and projected citrus acreage derived from the **Equation A-3**.

Table A-18. Historical and Projected Citrus Acreage in Southern Orange County.

Year	Historical Acreage	Projected Orange County Acreage	Projected Southern Orange County Acreage
1966	65,817		
1968	68,005		
1970	65,961		
1972	65,067		
1974	56,320		
1976	54,007		
1978	51,174		
1980	50,673		
1982	48,547		
1984	16,670		
1986	14,692		
1988	17,356		
1990	8,399		
1992	9,470		
1994	10,402		
1996	10,029		
1998	9,188		
2000	8,095		4,497
2002	6,884	6,884	3,824
2005		5,563	3,090
2010		4,204	2,336
2015		3,172	1,762
2020		2,368	1,316
2025		1,753	974

Note: 5/9 of county acreage within the SFWMD

Table A-19 shows the projected irrigation demands associated with the 2000 and projected citrus acreages in Southern Orange County.

Table A-19. Irrigation Requirements for Projected Citrus Acreage in Southern Orange County.

		2000	2005	2010	2015	2020	2025
Southern Orange County Irrigated Acreage		4,497	3,090	2,336	1,762	1,316	974
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.23	37	25	19	14	11	8
February	0.45	72	49	37	28	21	16
March	1.50	239	165	124	94	70	52
April	2.25	359	247	187	141	105	78
May	2.70	431	296	224	169	126	93
June	1.20	192	132	100	75	56	41
July	0.30	48	33	25	19	14	10
August	0.15	24	16	12	9	7	5
September	0.23	37	25	19	14	11	8
October	0.38	61	42	32	24	18	13
November	0.30	48	33	25	19	14	10
December	0.23	37	25	19	14	11	8
Total	9.92	1,584	1,088	823	620	463	343
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.35	216	148	112	84	63	47
February	1.43	228	157	119	89	67	49
March	2.70	431	296	224	169	126	93
April	3.75	599	411	311	235	175	130
May	4.95	790	543	410	310	231	171
June	2.48	396	272	206	155	116	86
July	0.38	61	42	32	24	18	13
August	0.00	0	0	0	0	0	0
September	1.28	204	140	106	80	60	44
October	0.98	156	107	81	61	46	34
November	1.35	216	148	112	84	63	47
December	1.35	216	148	112	84	63	47
Total	22.00	3,512	2,413	1,824	1,376	1,028	761

Western Osceola County

Citrus acreage in Osceola County was projected using robust regression. The model parameters are presented in **Equation A-4**.

Equation A-4.

Regression Equation Section

Independent Variable	Regression Coefficient	Standard Error	T-Value (H0:B=0)	Prob Level	Decision (5%)?	Power (5%)
Intercept	9.850824	7.338432E-03	1342.3610	0.000000	Reject Ho	1.000000
D	-0.2103109	7.716821E-03	-27.2536	0.000000	Reject Ho	1.000000
TIME	-2.011752E-03	5.107402E-04	-3.9389	0.004303	Reject Ho	0.929985
LOGTIME	-4.035884E-02	5.246543E-03	-7.6925	0.000058	Reject Ho	0.999998
R-Squared	0.994727					

Regression Coefficient Section

Independent	Regression Coefficient	Standard Error	Lower 95% C.L.	Upper 95% C.L.	Standardized Coefficient
Intercept	9.850824	7.338432E-03	9.833902	9.867747	0.000000
D	-0.2103109	7.716821E-03	-0.2281059	-0.1925159	-0.709854
TIME	-2.011752E-03	5.107402E-04	-3.189521E-03	-8.339831E-04	-0.219370
LOGTIME	-4.035884E-02	5.246543E-03	-5.245739E-02	-2.826029E-02	-0.430974
T-Critical	2.306004				

Analysis of Variance Section

Source	Power DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	926.6229	926.6229			
Model	3	7.848341E-02	2.616114E-02	503.0801	0.000000	1.000000
Error	8	4.160154E-04	5.200193E-05			
Total (Adjusted)	11	7.889942E-02	7.172675E-03			

Goodness-of-fit Statistics

Root Mean Square Error	7.211236E-03	R-Squared	0.994727
Mean of Dependent Variable	9.68122	Adj R-Squared	0.992750
Coefficient of Variation	7.448685E-04		

Table A-20 shows historical and projected Osceola County citrus acreage derived from the model shown in **Equation A-4**.

Table A-20. Historical and Projected Citrus Acreage in Western Osceola County.

Year	Historical County Acreage	Projected Osceola County Acreage	Projected Western Osceola County Acreage
1966	18,921		
1968	19,363		
1970	19,051		
1972	11,587		
1974	17,115		
1976	16,922		
1978	16,231		
1980	16,457		
1982	17,959		
1984	16,133		
1986	13,035		
1988	14,114		
1990	16,101		
1992	15,625		
1994	15,654		
1996	15,404		
1998	15,535		
2000	10,090		9,333
2002	7,964	7,964	7,367
2005		7,893	7,301
2010		7,777	7,193
2015		7,666	7,091
2020		7,560	6,993
2025		7,458	6,899

Note: 92.5% of county acreage in SFWMD.

Table A-21 shows the projected irrigation demands associated with the 2000 and projected citrus acreages in Western Osceola County.

Table A-21. Irrigation Requirements for Projected Citrus Acreage in Western Osceola County.

		2000	2005	2010	2015	2020	2025
Western Osceola County Irrigated Acreage		9,333	7,301	7,193	7,091	6,993	6,899
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.23	74	58	57	56	56	55
February	0.30	97	76	75	74	73	72
March	0.75	242	189	187	184	181	179
April	2.33	752	588	580	572	564	556
May	2.40	775	606	597	589	581	573
June	0.90	291	227	224	221	218	215
July	0.23	74	58	57	56	56	55
August	0.15	48	38	37	37	36	36
September	0.30	97	76	75	74	73	72
October	0.23	74	58	57	56	56	55
November	0.23	74	58	57	56	56	55
December	0.08	26	20	20	20	19	19
Total	8.13	2,625	2,053	2,023	1,994	1,967	1,940
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.65	533	417	411	405	399	394
February	1.58	510	399	393	388	382	377
March	2.23	720	563	555	547	539	532
April	3.75	1,211	947	933	920	907	895
May	3.90	1,259	985	970	957	943	931
June	1.88	607	475	468	461	455	449
July	1.50	484	379	373	368	363	358
August	0.00	0	0	0	0	0	0
September	0.23	74	58	57	56	56	55
October	0.00	0	0	0	0	0	0
November	1.58	510	399	393	388	382	377
December	1.46	471	369	363	358	353	348
Total	19.76	6,380	4,991	4,917	4,847	4,780	4,716

Eastern Polk County

Citrus acreage in Polk County was projected using log damped trend exponential smoothing. Time series data at two-year increments was used to estimate the damped trend exponential smoothing model.

Equation A-5.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	0.82462	.1800	4.5808	.0003
TREND Smoothing Weight	0.00100	.1297	0.00708	.9939
DAMPING Smoothing Weight	0.99253	.0160	62.0097	<.0001
Smoothed Level	11.51306			
Smoothed Trend	-0.02092			

Goodness-of-fit Statistics:

	Value
Mean Square Error	39209648
Root Mean Square Error	6261.8
Mean Absolute Percent Error	3.45317
Mean Absolute Error	3807.9
R-Square	0.902

Table A-22 shows historical and projected Polk County citrus acreage derived from the **Equation A-5**.

Table A-22. Historical and Projected citrus acreage in Eastern Polk County.

Year	Historical Acreage	Projected Polk County Acreage	Projected Eastern Polk County Acreage
1966	149,287		
1968	150,249		
1970	150,122		
1972	144,153		
1974	141,475		
1976	137,693		
1978	134,261		
1980	132,124		
1982	133,545		
1984	129,912		
1986	106,993		
1988	108,546		
1990	99,718		
1992	91,899		
1994	104,007		
1996	103,884		
1998	102,457		
2000	101,484		2,537
2002	100,202	100,202	2,505
2005		98,086	2,452
2010		93,545	2,339
2015		89,314	2,233
2020		85,345	2,134
2025		81,639	2,041

Note: 2.5 % of Polk County Citrus within SFWMD.

Table A-23 shows the projected irrigation demands associated with the 2000 and projected citrus acreages in Eastern Polk County.

Table A-23. Irrigation Requirements for Projected Citrus Acreage in Eastern Polk County.

		2000	2005	2010	2015	2020	2025
Eastern Polk County Irrigated Acreage		2,537	2,452	2,339	2,233	2,134	2,041
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.38	32	30	29	28	27	25
February	0.45	37	36	34	33	31	30
March	1.58	131	127	121	115	110	106
April	2.70	224	217	207	197	189	180
May	2.78	231	223	213	203	194	186
June	1.20	100	96	92	88	84	80
July	0.30	25	24	23	22	21	20
August	0.15	12	12	11	11	10	10
September	0.38	32	30	29	28	27	25
October	0.60	50	48	46	44	42	40
November	0.53	44	43	41	39	37	35
December	0.53	44	43	41	39	37	35
Total	11.58	961	929	886	846	809	773
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.43	119	115	109	104	100	95
February	1.43	119	115	109	104	100	95
March	2.63	218	211	201	192	184	176
April	4.43	368	355	339	324	309	296
May	4.43	368	355	339	324	309	296
June	2.48	206	199	190	181	173	166
July	1.20	100	96	92	88	84	80
August	0.00	0	0	0	0	0	0
September	0.83	69	67	64	61	58	55
October	1.28	106	103	98	94	89	85
November	1.13	94	91	86	83	79	75
December	1.43	119	115	109	104	100	95
Total	22.70	1,884	1,821	1,737	1,658	1,585	1,516

Eastern Highlands County

Citrus acreage in Highlands County was projected using damped trend exponential smoothing. Time series data at two-year increments was used to estimate the damped trend exponential smoothing model.

Equation A-6.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	0.78275	0.2902	2.6969	0.0159
TREND Smoothing Weight	0.999	0.9822	1.0171	0.3243
DAMPING Smoothing Weight	0.77385	0.1918	4.0339	.001
Smoothed Level	77617			
Smoothed Trend	-214.2116			

Goodness-of-fit Statistics:

	Value
Mean Square Error	9403633.9
Root Mean Square Error	3066.5
Mean Absolute Percent Error	3.67472
Mean Absolute Error	2074.0
R-Square	0.965

Table A-24 shows historical and projected Eastern Highlands County citrus acreage derived from **Equation A-6**.

Table A-24. Historical and Projected Citrus Acreage in Eastern Highlands County.

Year	Historical Citrus Acreage	Projected Highlands County Acreage	Projected Eastern Highlands County Acreage
1966	37,409		
1968	39,110		
1970	38,803		
1972	37,765		
1974	37,996		
1976	37,375		
1978	37,105		
1980	37,767		
1982	37,661		
1984	44,030		
1986	46,012		
1988	48,569		
1990	57,048		
1992	62,717		
1994	74,035		
1996	76,586		
1998	75,909		
2000	78,132		27,346
2002	77,391	77,391	27,087
2005		76,346	26,721
2010		76,106	26,637
2015		75,983	26,594
2020		75,916	26,571
2025		75,882	26,559

Note: 35% of Highlands County Citrus Assumed to be in SFWMD.

Table A-25 shows the projected irrigation demands associated with the 2000 and projected citrus acreages in Eastern Highlands County.

Table A-25. Irrigation Requirements for Projected Citrus Acreage in Eastern Highlands County.

		2000	2005	2010	2015	2020	2025
Eastern Highlands County Irrigated Acreage		27,346	26,721	26,637	26,954	26,571	26,559
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.68	623	609	607	614	606	605
February	0.83	761	744	741	750	739	739
March	1.95	1,788	1,747	1,741	1,762	1,737	1,736
April	2.78	2,549	2,490	2,483	2,512	2,476	2,475
May	2.70	2,475	2,419	2,411	2,440	2,405	2,404
June	0.90	825	806	804	813	802	801
July	0.23	211	206	205	208	205	205
August	0.23	211	206	205	208	205	205
September	0.15	138	134	134	136	134	134
October	0.45	413	403	402	407	401	401
November	0.68	623	609	607	614	606	605
December	0.53	486	475	473	479	472	472
Total	12.11	11,102	10,849	10,815	10,943	10,788	10,783
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.43	1,311	1,281	1,277	1,292	1,274	1,273
February	2.33	2,136	2,087	2,081	2,106	2,076	2,075
March	3.83	3,511	3,431	3,420	3,461	3,412	3,410
April	4.65	4,263	4,166	4,153	4,202	4,142	4,140
May	4.58	4,199	4,103	4,090	4,139	4,080	4,078
June	1.88	1,724	1,684	1,679	1,699	1,675	1,674
July	1.28	1,174	1,147	1,143	1,157	1,140	1,140
August	1.28	1,174	1,147	1,143	1,157	1,140	1,140
September	0.00	0	0	0	0	0	0
October	1.13	1,036	1,012	1,009	1,021	1,007	1,006
November	1.43	1,311	1,281	1,277	1,292	1,274	1,273
December	2.18	1,999	1,953	1,947	1,970	1,942	1,941
Total	26.00	23,837	23,292	23,219	23,495	23,161	23,151

Northern Glades County

The majority of citrus land in Northern Glades County is under the control of a few large growers, and these growers have communicated to the SFWMF that they have no further expansion plans in Northern Glades County. Therefore, citrus acreage is projected to remain at its most recent observed value, as shown in **Table A-26**.

Table A-26. Historical Citrus Acreage in Glades County.

Year	Historical Acreage	Projected Glades County Acreage	Projected Northern Glades County Acreage
1966	1,413		
1968	1,461		
1970	1,572		
1972	1,639		
1974	1,661		
1976	1,615		
1978	1,613		
1980	3,395		
1982	4,026		
1984	5,141		
1986	6,076		
1988	6,235		
1990	7,523		
1992	9,136		
1994	9,270		
1996	9,402		
1998	10,776		
2000	10,506		5,043
2002	10,384	10,384	4,984

Note: 48% of Glades County citrus in Kissimmee Basin.

Table A-27 shows the projected irrigation demands associated with the 2000 and projected citrus acreages in Northern Glades County.

Table A-27. Irrigation Requirements for Projected Citrus Acreage in Northern Glades County.

		2000	2005	2010	2015	2020	2025
Northern Glades County Irrigated Acreage		5,043	4,984	4,984	4,984	4,984	4,984
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.75	145	143	143	143	143	143
February	1.05	203	200	200	200	200	200
March	2.18	420	416	416	416	416	416
April	2.93	565	559	559	559	559	559
May	2.85	550	543	543	543	543	543
June	0.90	174	172	172	172	172	172
July	0.45	87	86	86	86	86	86
August	0.53	102	101	101	101	101	101
September	0.30	58	57	57	57	57	57
October	0.45	87	86	86	86	86	86
November	0.98	189	187	187	187	187	187
December	0.83	160	158	158	158	158	158
Total	14.20	2,739	2,707	2,707	2,707	2,707	2,707
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.65	318	315	315	315	315	315
February	1.88	363	358	358	358	358	358
March	3.68	710	702	702	702	702	702
April	4.95	955	944	944	944	944	944
May	4.88	941	930	930	930	930	930
June	1.20	231	229	229	229	229	229
July	2.33	449	444	444	444	444	444
August	1.05	203	200	200	200	200	200
September	1.28	247	244	244	244	244	244
October	1.05	203	200	200	200	200	200
November	2.03	392	387	387	387	387	387
December	2.03	392	387	387	387	387	387
Total	28.01	5,403	5,339	5,339	5,339	5,339	5,339

Western Okeechobee County

Citrus acreage in Okeechobee County was projected using linear exponential smoothing. Time series data at two-year increments was used to estimate the damped trend exponential smoothing model.

Equation A-7.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	0.999	0.1734	5.7607	<.0001
TREND Smoothing Weight	0.01624	0.036	0.4513	0.6574
Residual Value (sigma squared)	456772			
Smoothed Level	10385			
Smoothed Trend	564.4506			

Goodness-of-fit Statistics:

	Value
Mean Square Error	408690.5
Root Mean Square Error	639.289
Mean Absolute Percent Error	16.60958
Mean Absolute Error	572.786
R-Square	0.968

Equation A-7 was used to project citrus acreage in Okeechobee County, and resulting projections are shown in **Table A-28**.

Table A-28. Historical and Projected Citrus Acreage in Eastern Okeechobee County.

Year	Historical County Acreage	Projected Okeechobee County Acreage	Projected Western Okeechobee County Acreage
1966	2,508		
1968	3,329		
1970	3,597		
1972	3,676		
1974	4,087		
1976	4,162		
1978	4,171		
1980	4,281		
1982	6,954		
1984	8,044		
1986	7,449		
1988	8,124		
1990	8,541		
1992	10,439		
1994	11,270		
1996	12,206		
1998	12,244		
2000	12,170		3,408
2002	12,035	12,035	3,370
2005		12,878	3,606
2010		14,831	4,143
2015		16,214	4,540
2020		17,587	4,924
2025		18,134	5,078

Note: 28% of Okeechobee citrus in the Kissimmee Basin.

Table A-29 shows the projected irrigation demands associated with the 2000 and projected citrus acreages in Western Okeechobee County.

Table A-29. Irrigation Requirements for Projected Citrus Acreage in Western Okeechobee County.

		2000	2005	2010	2015	2020	2025
Western Okeechobee County Irrigated Acreage		3,408	3,606	4,153	4,540	4,924	5,078
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.83	94	100	115	126	136	140
February	0.83	94	100	115	126	136	140
March	2.10	238	252	291	318	345	355
April	2.33	265	280	322	352	382	394
May	2.55	290	306	353	386	418	431
June	1.05	119	126	145	159	172	178
July	0.38	43	46	53	57	62	64
August	0.38	43	46	53	57	62	64
September	0.15	17	18	21	23	25	25
October	0.23	26	28	32	35	38	39
November	0.90	102	108	125	136	148	152
December	0.60	68	72	83	91	98	102
Total	12.33	1,400	1,481	1,706	1,865	2,023	2,086
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.65	187	198	228	250	271	279
February	1.73	196	208	239	262	284	293
March	3.83	435	460	530	579	628	648
April	4.28	486	514	592	647	702	724
May	5.03	571	604	696	761	825	851
June	2.25	255	270	311	340	369	381
July	0.83	94	100	115	126	136	140
August	0.45	51	54	62	68	74	76
September	0.00	0	0	0	0	0	0
October	1.28	145	154	177	194	210	217
November	1.73	196	208	239	262	284	293
December	2.15	244	258	298	325	353	364
Total	25.21	2,863	3,029	3,489	3,814	4,136	4,266

Vegetables, Melons and Berries

Vegetable crops were grouped together for projection purposes. This was validated by the lack of significant difference between the irrigation requirements of the different types of vegetables cultivated in the KB Planning Area, and the production practices used on vegetable farms (different types of vegetables are sometimes grown interchangeably). Vegetables in the KB planning area are grown commercially in Osceola, Polk, Highlands, Glades and Okeechobee Counties.

Vegetable fields are planted and harvested sequentially, and some portion of the total acreage used for vegetable production is commonly vacant. This temporal area of vegetable land vacancy effects total irrigation requirements, but it is difficult to quantify. Production timing may change for several reasons. For example, growers may enter into a contract to harvest vegetables in a specific time window, which would in turn determine their growing season. Also, as seepage irrigation is the predominant type of irrigation system used for vegetable production, some of these vacant fields are unavoidably irrigated, either in part or whole. With these constraints in mind, cultivation schedules were developed on which to calculate irrigation requirements.

In addition to vegetable crops (which typically use seepage irrigation systems), there are also about 200 acres of blueberries (on micro irrigation) in Eastern Highlands County. **Table A-30** outlines the seasonal vegetable acreage and irrigation requirements in the Kissimmee Basin Planning Area, and **Table A-31** shows blueberry irrigation demands.

Table A-30. Irrigation Requirements for Projected Vegetable Acreage in the Kissimmee Basin.

	Western Osceola	Western Osceola	Eastern Polk	Eastern Polk	Eastern Highlands	Eastern Highlands	Northern Glades	Northern Glades	Western Okeecho.	Western Okeecho.
Irrigated Acreage		2,432		588		3,445		1,248		4,777
Average	Net Irr. Req. (inches)	Million Gallons	Net Irr. Req. (inches)	Million gallons	Net Irr. Req. (inches)	Million gallons	Net Irr. Req. (inches)	Million gallons	Net Irr. Req. (inches)	Million gallons
January	0.3	40	0.2	6	0.4	75	0.5	34	0.5	130
February	0.8	106	0.8	26	1.1	206	1.1	75	1.1	285
March	2.3	304	2.2	70	2.4	449	2.6	176	2.3	597
April	3.3	436	3.2	102	3.2	599	3.3	224	2.9	752
May – Aug	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
September	0.5	66	0.5	16	0.3	56	0.5	34	0.4	104
October	0.8	106	0.9	29	0.9	168	0.9	61	0.7	182
November	1.2	159	1.1	35	1.2	225	1.3	88	1.1	285
December	0.8	106	0.7	22	0.9	168	1.1	75	1.1	285
Total	10.0	1,321	9.6	307	10.4	1,946	11.3	766	10.1	2,620
1-in-10	Net Irr. Req. (inches)	Million Gallons	Net Irr. Req. (inches)	Million gallons	Net Irr. Req. (inches)	Million gallons	Net Irr. Req. (inches)	Million gallons	Net Irr. Req. (inches)	Million gallons
January	0.5	66	0.4	13	0.7	131	0.7	47	0.8	208
February	1.1	145	1.1	35	1.4	262	1.5	102	1.3	337
March	3.0	396	2.8	89	3.1	580	3.0	203	2.7	701
April	4.0	528	3.7	118	4.1	767	3.8	258	3.9	1,012
May – Aug	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
September	0.7	92	0.7	22	0.5	94	0.7	47	0.6	156
October	1.2	159	1.2	38	1.2	225	1.2	81	1.0	259
November	1.5	198	1.3	42	1.5	281	1.5	102	1.5	389
December	1.2	159	1.1	35	1.2	225	1.4	95	1.5	389
Total	13.2	1,744	12.3	393	13.7	2,563	13.8	935	13.3	3,451

Table A-31. Irrigation Requirements for Blueberry Acreage in Eastern Highlands County.

	Average Net Irrigation Req. (inches)	1-in-10 Net Irrigation Req. (inches)	Average Million Gallons	1-in-10 Average Million Gallons
January	0.7	1.4	4	9
February	0.8	2.3	5	15
March	2.0	3.8	13	24
April	2.8	4.7	18	30
May	2.7	4.6	17	29
June	0.9	1.9	6	12
July	0.2	1.3	1	8
Aug	0.2	1.3	1	8
September	0.2	0.0	1	0
October	0.5	1.1	3	7
November	0.7	1.4	4	9
December	0.5	2.2	3	14
Total	12.2	26.0	78	166

Note: Blueberry Acreage = 200

Field Crops

Sugarcane is the only field crop grown commercially in the Kissimmee Basin. Northern Glades County has historically been the only area where sugarcane has been grown in the KB, but recently there have been about 1,000 acres also planted in Highlands County.

Sugarcane is initially propagated vegetatively by planting stalk cuttings. The first harvest takes place approximately 13 months after planting. Roots are left in the ground (ratooned) and yield additional crops of sugarcane which take about 12 months to reach maturity. Sugar production per unit of land surface declines gradually and progressively with each additional ratoon, and there comes a point where the increased yields associated with replanting outweigh the cost of replanting. In Florida, this point comes on average after four years (one planting and three ratoons).

After the final ratoon in the cycle is harvested on a parcel of land from November through March, and before replanting takes place from September through January, there is no sugarcane on that parcel. In the KB, this land is invariably fallowed during this period. This means there is approximately 20 percent of the land associated with sugarcane production that will not be reported as production by FASS. This 20 percent of land will not require irrigation and is not included in the projections presented here.

Historical sugarcane acreage data were gathered from annual volumes of the Field Crops Summary, which is published by FASS, and are presented in **Table A-32**.

Historically there has been some fluctuation in sugarcane acreage in Glades County, however, in recent years acreage has stabilized, and the projection is for acreage to remain the at the 2000 level through 2025, with 17 percent (3,338 acres) of Glades County sugarcane acreage in the Kissimmee Basin.

Table A-32. Historical Sugarcane Acreage in Glades County.

Year	Glades County
1975	16,636
1976	18,545
1977	16,842
1978	18,260
1979	19,454
1980	20,096
1981	22,908
1982	22,904
1983	22,924
1984	26,015
1985	15,599
1986	17,165
1987	20,020
1988	20,321
1989	20,119
1990	19,633
1991	19,633
1992	19,633
1993	19,633
1994	19,633
1995	19,633
1996	19,633
1997	19,633
1998	19,633
1999	20,942
2000	19,633

The mean and 1-in-10 irrigation requirements for sugarcane in Northern Glades and Eastern Highlands Counties are shown in **Table A-33**.

Table A-33. Irrigation Requirements for Projected Sugarcane Acreage in the Kissimmee Basin.

	Northern Glades County			Eastern Highlands County	
	2000		2005 to 2025	2005 to 2025	
Irrigated Acreage	3,338		4,438	1,000	
Average	2000 Net Irrigation Requirements (inches)	2000 Gross Irrigation Requirements (million gallons)	2005 to 2025 Gross Irrigation Requirements (million gallons)	2005 to 2025 Net irrigation Requirements (inches)	2005 to 2025 Gross Irrigation Requirements (million gallons)
January	1.3	231	307	0.7	38
February	1.7	313	416	0.5	27
March	2.5	449	597	1.3	71
April	3.2	585	777	2.5	136
May	3.2	571	759	2.9	158
June	1.6	286	380	1.1	60
July	1.3	231	307	0.8	43
August	1.1	190	253	0.6	33
September	0.8	150	199	0.5	27
October	1.2	218	289	0.9	49
November	1.2	218	289	0.8	43
December	1.2	218	289	0.7	38
Total	20.2	3,658	4,863	13.3	722
1-in-10					
January	1.8	328	436	1.0	54
February	2.0	359	477	0.8	43
March	2.8	503	668	1.7	92
April	4.0	718	955	3.2	174
May	4.1	749	995	3.5	190
June	2.4	431	573	1.6	87
July	1.9	338	450	1.2	65
August	1.6	287	382	0.9	49
September	1.2	215	286	0.6	33
October	1.5	277	368	1.3	71
November	1.5	267	355	1.1	60
December	1.6	287	382	1.0	54
Total	26.3	4,759	6,327	17.9	972

Sod

The sod projections presented here refer to irrigated sod. There is additional sod harvested from pastureland which is not irrigated. Sod in the KB planning area is grown commercially in Osceola, Polk, Highlands, Glades and Okeechobee Counties. Irrigation requirements are presented in **Table A-34**.

Table A-34. Irrigation Requirements for Projected Sod Acreage in the Kissimmee Basin.

	Western Osceola	Western Osceola	Eastern Polk	Eastern Polk	Eastern Highlands	Eastern Highlands	Northern Glades	Northern Glades	Western Okeecho.	Western Okeecho.
Irrigated Acreage		500		1,000		900		300		250
Average	Net Irr. Req. (inches)	2000 (million gallons)	Net Irr. Req. (inches)	2000 (million gallons)	Net Irr. Req. (inches)	2000 (million gallons)	Net Irr. Req. (inches)	2000 (million gallons)	Net Irr. Req. (inches)	2000 (million gallons)
January	1.1	30	1.0	54	1.3	64	1.4	23	1.3	18
February	1.4	38	1.4	76	1.6	78	1.9	31	1.7	23
March	2.4	65	2.3	125	2.6	127	2.8	46	2.5	34
April	3.6	98	3.6	196	3.7	181	3.7	60	3.2	43
May	3.5	95	3.5	190	3.5	171	3.5	57	3.2	43
June	1.6	43	1.7	92	1.4	68	1.5	24	1.6	22
July	1.3	35	1.1	60	1.2	59	1.6	26	1.3	18
August	1.1	30	0.9	49	1.0	49	1.3	21	1.1	15
September	1.1	30	1.1	60	0.8	39	1.1	18	0.8	11
October	1.4	38	1.4	76	1.4	68	1.4	23	1.2	16
November	1.2	33	1.2	65	1.3	64	1.4	23	1.2	16
December	0.8	22	0.8	43	1.0	49	1.2	20	1.2	16
Total	20.5	557	20.0	1,086	20.8	1,017	22.8	371	20.3	276
1-in-10	Net Irr. Req. (inches)	2000 (million gallons)	Net Irr. Req. (inches)	2000 (million gallons)	Net Irr. Req. (inches)	2000 (million gallons)	Net Irr. Req. (inches)	2000 (million gallons)	Net Irr. Req. (inches)	2000 (million gallons)
January	1.4	38	1.5	76	2.2	108	2.3	37	1.8	24
February	0.3	8	1.9	103	2.6	127	2.9	47	2.0	27
March	2.7	73	3.4	185	4.1	200	4.2	68	2.8	38
April	3.7	100	4.8	261	5.3	259	5.4	88	4.0	54
May	3.8	103	4.9	266	5.0	244	5.2	85	4.1	56
June	2.2	60	2.9	158	2.8	137	2.8	46	2.4	33
July	1.9	52	2.1	114	2.3	112	2.9	47	1.9	26
August	1.2	33	1.7	92	1.9	93	2.6	42	1.6	22
September	1.4	38	2.0	109	1.5	73	2.0	33	1.2	16
October	1.8	49	2.1	114	2.3	112	2.4	39	1.5	20
November	1.4	38	1.8	98	2.0	98	2.0	33	1.5	20
December	1.6	43	1.6	87	1.7	83	1.9	31	1.6	22
Total	23.4	635	30.7	1,662	33.7	1,647	36.6	596	26.4	358

Greenhouse/Nursery

Ornamental nurseries in the Kissimmee Basin Planning Area are in Orange, Osceola, Highlands and Okeechobee Counties. Highlands County also has a significant acreage of caladium farms.

Southern Orange County

Orange County ornamental nursery acreage has increased relatively steadily. Minor declines occurred in the aftermath of major freezes, but the overall trend of ornamental nursery acreage has been upward. The statistical model selected is linear exponential smoothing. This model extrapolates an increase of about 34 acres of nurseries per year in Orange County, about a quarter of which is the Kissimmee Basin, and this was kept constant throughout the projection period. **Equation A-8** was used to project the nursery acreages shown in **Table A-35**, which have irrigation demands shown in **Table A-36**.

Equation A-8.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	0.6659	0.1374	4.846	<.001
TREND Smoothing Weight	0.00619	0.0405	0.1529	0.8796
Residual Value (sigma squared)	5734			
Smoothed Level	1773			
Smoothed Trend	34.12516			
Goodness-of-fit Statistics:	Value			
Mean Square Error	5338.5			
Root Mean Square Error	73.0652			
Mean Absolute Percent Error	4.79761			
Mean Absolute Error	57.27885			
R-Square	0.932			

Table A-35. Historical and Projected Nursery Acreage in Southern Orange County.

Year	Historical County Acreage	Projected Orange County Acreage	Projected Southern Orange County Acreage
1972	682		
1973	711		
1974	688		
1975	922		
1976	842		
1977	907		
1978	946		
1979	985		
1980	985		
1981	1,097		
1982	1,155		
1983	1,187		
1984	1,090		
1985	1,110		
1986	1,203		
1987	1,319		
1988	1,183		
1989	1,285		
1990	1,312		
1991	1,224		
1992	1,261		
1993	1,292		
1994	1,338		
1995	1,307		
1996	1,428		
1997	1,550		
1998	1,636		
1999	1,689		
2000	1,806	1,806	452
2005		2,043	511
2010		2,214	554
2015		2,385	596
2020		2,555	639
2025		2,626	657

Table A-36. Irrigation Requirements for Projected Greenhouse/Nursery in Southern Orange County.

		2000	2005	2010	2015	2020	2025
Southern Orange County Irrigated Acreage		452	511	554	596	639	657
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	0.9	15	17	18	19	21	21
February	1.4	23	26	28	30	32	33
March	2.3	38	43	46	50	53	55
April	3.5	57	65	70	76	81	83
May	3.5	57	65	70	76	81	83
June	2.0	33	37	40	43	46	48
July	1.7	28	31	34	37	39	40
August	1.2	20	22	24	26	28	29
September	1.1	18	20	22	24	25	26
October	1.3	21	24	26	28	30	31
November	1.1	18	20	22	24	25	26
December	0.8	13	15	16	17	19	19
Total	20.8	340	385	417	449	481	495
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.1	18	20	22	24	25	26
February	1.6	26	30	32	35	37	38
March	2.5	41	46	50	54	58	59
April	4.0	65	74	80	86	93	95
May	4.0	65	74	80	86	93	95
June	2.6	43	48	52	56	60	62
July	2.1	34	39	42	45	49	50
August	1.8	29	33	36	39	42	43
September	1.6	26	30	32	35	37	38
October	1.4	23	26	28	30	32	33
November	1.3	21	24	26	28	30	31
December	1.0	16	19	20	22	23	24
Total	25.0	409	463	501	539	578	595

Western Osceola County

All nursery acreage in Osceola County is within the Kissimmee Basin (Western Osceola County), and this was kept constant throughout the projection period. Osceola County ornamental nursery acreage peaked at 271 acres in 1998. Since 1998, Osceola nursery acreage has declined slightly. A damped trend exponential smoothing model was estimated and a slight long-term decline in Osceola acreage (from about 246 acres to a long-term acreage of about 232 acres). **Equation A-9** was used to project the nursery acreages shown in **Table A-37**, which have irrigation demands shown in **Table A-38**.

Equation A-9.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	0.76134	0.4964	1.5338	0.1376
TREND Smoothing Weight	0.999	2.4802	0.4028	0.6905
DAMPING Smoothing Weight	0.55065			
Residual Variance (sigma squared)	4437			
Smoothed Level	256.2292			
Smoothed Trend	-19.376			
Goodness-of-fit Statistics:	Value			
Mean Square Error	3961.8			
Root Mean Square Error	62.94301			
Mean Absolute Percent Error	21.50285			
Mean Absolute Error	40.93683			
R-Square	0.814			

Table A-37. Historical and Projected Nursery Acreage in Western Osceola County.

Year	Historical Osceola County Acreage	Projected Western Osceola County Acreage
1972	30	
1973	29	
1974	29	
1975	30	
1976	20	
1977	22	
1979	24	
1980	35	
1981	166	
1982	191	
1983	200	
1984	230	
1985	204	
1986	358	
1987	329	
1988	461	
1989	498	
1990	477	
1991	365	
1992	350	
1993	168	
1994	113	
1995	106	
1996	168	
1997	229	
1998	267	
1999	271	
2000	248	248
2005		199
2010		199
2015		198
2020		198
2025		198

Table A-38. Irrigation Requirements for Projected Greenhouse/Nursery Acreage in Western Osceola County.

		2000	2005	2010	2015	2020	2025
Western Osceola County Irrigated Acreage		248	199	199	198	198	198
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.3	12	9	9	9	9	9
February	1.7	15	12	12	12	12	12
March	2.7	24	19	19	19	19	19
April	3.9	35	28	28	28	28	28
May	3.6	32	26	26	26	26	26
June	1.9	17	14	14	14	14	14
July	1.5	13	11	11	11	11	11
August	1.3	12	9	9	9	9	9
September	1.3	12	9	9	9	9	9
October	1.7	15	12	12	12	12	12
November	1.4	13	10	10	10	10	10
December	1.1	10	8	8	8	8	8
Total	23.4	210	169	169	168	168	168
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.5	13	11	11	11	11	11
February	1.8	16	13	13	13	13	13
March	3.0	27	22	22	22	22	22
April	4.0	36	29	29	29	29	29
May	4.1	37	30	30	29	29	29
June	2.4	22	17	17	17	17	17
July	2.2	20	16	16	16	16	16
August	1.6	14	12	12	11	11	11
September	2.0	18	14	14	14	14	14
October	1.9	17	14	14	14	14	14
November	1.6	14	12	12	11	11	11
December	1.4	13	10	10	10	10	10
Total	27.5	247	198	198	197	197	197

Eastern Highlands County

Highlands County ornamental nursery has increased rapidly since about 1990. In 1991 there were 166 acres of ornamental nurseries in Highlands County. By 1993 this acreage has increased to 1,339 acres, and by 2000 there were 2,226 acres of ornamental nurseries in Highlands County. A linear exponential smoothing model gave the best fit to the observed acreage. This model projects ornamental nursery acreage in Highlands County to increase to approximately 4,400 acres by 2025. This represents slightly less than a doubling of ornamental nursery acreage from its 2000 level. About 20 percent of the ornamental nursery acreage in Highlands County is within the Kissimmee Basin, and this was kept constant throughout the projection period. **Equation A-10** was used to project the nursery acreages shown in **Table A-39**, which have irrigation demands shown in **Table A-40**.

Equation A-10.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	0.999	.1503	6.6468	<.0001
TREND Smoothing Weight	0.001	.0578	0.0173	.9863
Residual Variance (sigma squared)	63950			
Smoothed Level	2226			
Smoothed Trend	78.48156			
Goodness-of-fit Statistics:	Value			
Mean Square Error	59030.8			
Root Mean Square Error	242.9626			
Mean Absolute Percent Error	36.80166			
Mean Absolute Error	129.3104			
R-Square	0.883			

In addition to the ornamental nursery acreage shown in **Table A-39**, Eastern Highlands County has a significant acreage of caladiums. Highlands County produces over 90 percent of the world's caladium bulbs, and the production area is inside the Kissimmee Basin Planning Area. The acreage used by this industry has stabilized (at between 1,100 and 1,200 acres), and is projected to remain relatively constant through 2025. This acreage is not included as nursery acreage by the Division of Plant Industry (DPI). Demands for 1,200 acres of caladiums are included in **Table A-40** (along with ornamental nursery demands), which shows the greenhouse/nursery demand projections for Eastern Highlands County.

Table A-39. Historical and Projected Ornamental Nursery Acreage in Eastern Highlands County.

Year	Historical County Acreage	Projected Highlands County Acreage	Projected Eastern Highlands County Acreage
1975	167		
1976	171		
1977	173		
1978	144		
1979	152		
1980	159		
1981	229		
1982	180		
1983	185		
1984	202		
1985	216		
1986	435		
1987	272		
1988	187		
1989	281		
1990	176		
1991	166		
1992	168		
1993	1,349		
1994	1,577		
1995	1,587		
1996	1,627		
1997	1,667		
1998	1,778		
1999	1,882		
2000	2,226	2,226	445
2005		2,879	576
2010		3,272	654
2015		3,664	733
2020		4,057	811
2025		4,449	890

Table A-40. Irrigation Requirements for Projected Greenhouse/Nursery Acreage in Eastern Highlands County.

		2000	2005	2010	2015	2020	2025
Eastern Highlands County Irrigated Acreage		1,645	1,776	1,854	1,933	2,011	2,090
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.4	83	90	94	98	102	106
February	1.9	113	122	128	133	138	144
March	2.9	173	186	195	203	211	219
April	3.9	232	251	262	273	284	295
May	3.6	214	231	242	252	262	272
June	1.7	101	109	114	119	124	129
July	1.4	83	90	94	98	102	106
August	1.3	77	84	87	91	95	98
September	1.1	66	71	74	77	80	83
October	1.7	101	109	114	119	124	129
November	1.5	89	96	101	105	109	114
December	1.1	66	71	74	77	80	83
Total	23.5	1,400	1,511	1,578	1,645	1,711	1,778
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.9	113	122	128	133	138	144
February	2.2	131	141	148	154	160	166
March	3.2	191	206	215	224	233	242
April	4.2	250	270	282	294	306	318
May	3.9	232	251	262	273	284	295
June	2.5	149	161	168	175	182	189
July	2.1	125	135	141	147	153	159
August	1.7	101	109	114	119	124	129
September	1.5	89	96	101	105	109	114
October	1.9	113	122	128	133	138	144
November	1.6	95	103	107	112	117	121
December	1.3	77	84	87	91	95	98
Total	28.0	1,668	1,801	1,880	1,960	2,039	2,119

Western Okeechobee County

All nursery acreage in Okeechobee County is within the Kissimmee Basin (Western Okeechobee County), and this was kept constant throughout the projection period. Since the 1990s Okeechobee County ornamental nursery acreage has increased relatively steadily, reaching 815 acres in the year 2000. The statistical model which best fit the observed data was linear exponential smoothing. **Equation A-11** was used to project the nursery acreages shown in **Table A-41**, which have irrigation demands shown in **Table A-42**.

Equation A-11.

Model Parameters:	Estimate	Standard Error	T	Prob> T
LEVEL Smoothing Weight	0.999	0.1368	7.3008	<.0001
TREND Smoothing Weight	0.001	0.0344	0.0344	0.977
Residual Variance (sigma squared)	6894			
Smoothed Level	815.0028			
Smoothed Trend	30.85941			
Goodness-of-fit Statistics:				
	Value			
Mean Square Error	6418.3			
Root Mean Square Error	80.11421			
Mean Absolute Percent Error	175.9263			
Mean Absolute Error	54.3894			
R-Square	0.926			

Table A-41. Historical and Projected Ornamental Nursery Acreage in Western Okeechobee County.

Year	Historical County Acreage	Projected Western Okeechobee County Acreage
1972	5	
1973	4	
1974	6	
1975	5	
1976	6	
1977	6	
1978	7	
1979	8	
1980	48	
1981	40	
1982	16	
1983	18	
1984	20	
1985	29	
1986	36	
1987	159	
1988	20	
1989	74	
1990	86	
1991	241	
1992	491	
1993	494	
1994	452	
1995	714	
1996	730	
1997	746	
1998	680	
1999	787	
2000	815	815
2005		912
2010		1,009
2015		1,107
2020		1,204
2025		1,302

Table A-42. Irrigation Requirements for Projected Greenhouse/Nursery Acreage in Western Okeechobee County.

		2000	2005	2010	2015	2020	2025
Western Okeechobee County Irrigated Acreage		815	912	1,009	1,107	1,204	1,302
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
Average	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.6	47	53	58	64	70	75
February	2.0	59	66	73	80	87	94
March	2.7	80	89	99	108	118	127
April	3.5	103	116	128	140	153	165
May	3.3	97	109	121	132	144	156
June	1.9	56	63	69	76	83	90
July	1.6	47	53	58	64	70	75
August	1.3	38	43	47	52	57	61
September	1.1	32	36	40	44	48	52
October	1.4	41	46	51	56	61	66
November	1.5	44	50	55	60	65	71
December	1.4	41	46	51	56	61	66
Total	23.3	688	769	851	934	1,016	1,098
Net Irrigation Requirements		2000	2005	2010	2015	2020	2025
1-in-10	(inches)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)	(million gallons)
January	1.8	53	59	66	72	78	85
February	2.3	68	76	84	92	100	108
March	3.0	89	99	110	120	131	141
April	4.1	121	135	150	164	179	193
May	4.3	127	142	157	172	187	203
June	2.6	77	86	95	104	113	123
July	2.2	65	73	80	88	96	104
August	2.1	62	69	77	84	92	99
September	1.5	44	50	55	60	65	71
October	1.8	53	59	66	72	78	85
November	1.7	50	56	62	68	74	80
December	1.7	50	56	62	68	74	80
Total	29.1	859	961	1,063	1,166	1,269	1,372

Improved Pasture

Improved pasture is defined by the District as pasture that has the facilities in place to carry out irrigation. There are about two hundred thousand acres encompassed in water use permits issued by the District for pasture irrigation in the Kissimmee Basin Planning Area in 2004. Based on District knowledge and consulting with local soil and water conservation district scientists, much of this acreage is rarely irrigated. This is because the returns associated with cattle production in recent years do not justify the expense associated with pasture irrigation. When irrigation is used, it is usually in a period of drought and is done to prevent grass from dying. In many cases, this occurs on a much smaller area of pasture than the “improved” total. Unless there is evidence of active pasture irrigation within a specific county, the irrigation of that acreage is not included in the primary projection scenario analyzed in the District’s regional water supply plans. Although this assumption may not be the case in some rare instances, it is much closer to actual production practices than the values given by any irrigation requirement model or permit.

The water supply planning assumption that improved pasture is not irrigated does not preclude ranchers from acquiring District Consumptive Use Permits, or carrying out pasture irrigation; however, this irrigation activity is not part of the primary projection for irrigation demand in a mean or 1-in-10 year drought.

Miscellaneous

Cattle Watering

Water required for cattle watering was assessed as a function of the number of and type (beef or dairy) of cattle. Water demand estimates for cattle watering is based on the District’s allocation of 12 gal/cow/day for beef cattle, and 150 gal/cow/day for dairy cattle, and kept constant over the projection horizon.

Table A-43. Cattle Watering Demands in the Kissimmee Basin Planning Area.

County Area	Total Non-Dairy Cattle	Dairy Cows	Total Cattle and Calves	MGY	MGD
Southern Orange	1,700	0	1,700	7	0.02
Western Osceola	62,400	0	62,400	273	0.75
Eastern Polk	35,343	500	35,843	182	0.50
Eastern Highlands	88,800	7,000	101,369	772	2.12
Northern Glades	50,692	0	50,692	222	0.61
Western Okeechobee	86,870	30,600	147,050	2,056	5.63
Total	325,805	38,100	399,054	3,513	9.62

Aquaculture

Aquacultural operations withdraw water for circulation purposes and to replace evaporative losses. Replacement quantities, outlined in **Table A-44**, were assessed for counties for which there are currently permitted consumptive uses for aquaculture (fish farming). There are no existing consumptive use permits for aquaculture in Southern Orange or Northern Glades Counties. Demands are projected to remain at a constant level through 2025.

Table A-44. Aquaculture Demands in the Kissimmee Basin Planning Area.

County Area	MGY	MGD
Western Osceola	203	0.56
Eastern Polk	2	0.01
Eastern Highlands	114	0.31
Western Okeechobee	229	0.63
Total	548	1.50

Total Irrigated Acreage

Irrigated agricultural acreages for the KB Planning Area are presented in **Table A-45**.

Table A-45. Irrigated Agricultural Acreage in the KB Planning Area.

Category	Southern Orange County	Western Osceola County	Eastern Polk County	Eastern Highlands County	Northern Glades County	Western Okeechobee County	Total KB	Percent of Total
2000								
Citrus	4,497	9,333	2,537	27,346	5,043	3,408	52,164	70.2%
Vegetables, melons and berries	0	2,432	588	3,645	1,248	4,777	12,690	17.1%
Field Crops (Sugarcane)	0	0	0	0	3,338	0	3,338	4.5%
Sod	0	500	1,000	900	300	250	2,950	4.0%
Greenhouse/Nursery	452	248	0	1,645	0	815	3,160	4.3%
Total	4,949	12,513	4,125	33,536	9,929	9,250	74,302	100.0%
2025								
Citrus	974	6,899	2,041	26,559	4,984	5,078	46,535	64.8%
Vegetables, melons and berries	0	2,432	588	3,645	1,248	4,777	12,690	17.7%
Field Crops (Sugarcane)	0	0	0	1,000	4,438	0	5,438	7.6%
Sod	0	500	1,000	900	300	250	2,950	4.0%
Greenhouse/Nursery	657	198	0	2,090	0	1,302	4,247	5.9%
Total	1,631	10,029	3,629	34,194	10,970	11,407	71,860	100.0%

Total Annual Water Demand

Estimated and projected demands for the KB Planning Area are shown in **Table A-46**.

Table A-46. Overall Water Demands for 2000 and 2025 (MGD).

Category	Assessed Demands 2000 (MGD)	Projected Demands 2025 (MGD)	Percent Change 2000- 2025
Public Water Supply	109.64	206.73	89%
Domestic Self-Supply	18.81	29.29	56%
Commercial & Industrial Self-Supply	13.83	24.71	79%
Recreational Self-Supply	8.49	20.78	145%
Thermoelectric Power Generation Self-Supply	0.46	0.46	0%
Agricultural Self-Supply	113.08	115.48	2%
Total	264.31	397.44	50%

Comparison with 2000 Kissimmee Basin Projected Water Demand

Table A-47 shows the average projected demands in the 2000 Kissimmee Basin Water Supply Plan and those projected in this update.

Table A-47. Average Projected Demands in the 2000 Kissimmee Basin Water Supply Plan and 2025 Update.

	2000 KBWSP for 2020	2005 KBWSP Update for 2025	Percent Change 2000 Plan (2020) vs. 2005 Update (2025)
Population	686,696	900,964	31%
Water Use	663.42	397.44	-40%
Public Water Supply (MGD)	145.30	206.73	42%
Domestic Self-Supply and Small Public Supply Systems (MGD)	11.80	29.29	148%
Commercial & Industrial Self-Supply (MGD)	5.80	24.71	326%
Recreational Self-Supply (MGD)	23.82	20.78	-13%
Thermoelectric Power Generation Self-Supply (MGD)	Not Addressed	0.46	
Agricultural Self-Supply (MGD)	476.70	115.48	-76%